Synopsis

Ph.D in Special Education

Enhancing Spoken Tamil Language Ability in Children with Autism Spectrum Disorder using PEsum SIthiram (PESI) Application

By

K.Manjula

17PHSEP004

Supervisor

Dr.T.Geetha

Former Professor

Department of Special Education

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Introduction

Birth with all functional organs is considered more important than being just born in this world (Zeidan J et al.,2022). In the present condition of running on wheels, "Autism" is more common in children with the Global Statistics revealing. One in a hundred with Children with Autism(WHO,2022) have problems in communicating and interacting with others. These children use a variety of traditional and non-conventional ways of communication, but the majority are not attentive enough to pick up on and correctly understand the meaning of these behaviours. Children with Autism have distinct learning qualities, and chooses a certain learning style. Teachers and educators who are not fully prepared to offer quality time to gain the child's attention he or she may find it difficult and stressful to meet the demands of Children with Autism Spectrum Disorder, especially in the classroom. To assist them in this condition of acquiring knowledge more successfully, teachers must utilize modern technologies. The importance of technology in the education of students with Autism Spectrum Disorder cannot be overstated. Several educational technology tools, including interactive whiteboards, smart phones, tablets, text-to-speech software, and digital editing tools, are used to help Children with Autism learn more effectively (Kingma and Ba, 2015). Due to the fact that impairments influence the user's learning style and lower the quantity of new skills memorized, these instructions describe a clear and validated framework of the user's individual instructional needs. As a result of these findings, there is a compelling rationale for using mobile apps to educate and train children with ASD.

Autism Spectrum Disorder (ASD) is a complex disorder and children with a diagnosis of ASD display varied behaviours of difficulties. The occurrence of ASD has raised concerns at the local , National as well as International levels which has led to action (Rice et al.,2012) and in the recent decade there has been a rapid increase in the number of children with autism worldwide (Hasan, 2020).

PEsum SIthiram(PESI) is an Application developed in line with **Picture Exchange Communication System** (PECS). This App is designed to enhance Spoken Tamil language ability in Children with Autism titled **"PEsum SIthiram"**(PESI) consisted of three identified concepts namely Relationships, Objects and Action words in Tamil. All the three concepts were taught separately as a single word. Ongoing a thorough knowledge about the three concepts, the children were trained to combine two word and then three word to formulate sentence verbally. These concepts that are on the bases of family, frequency usage of words, environment, nature, basic were taught and educational needs of the children with Autism Spectrum Disorder.

In Autism, receptive language is often seen to lag behind expressive language. However, this, too, may be related to a lack of social reciprocity as the parents of a child on the spectrum often remark how their children appear to tune out of conversational exchanges. Often, children with ASD tend to ignore voices around them though they do respond to other non-vocal stimuli, reflecting their disengagement from the social world. Children on the spectrum frequently have attention issues, with difficulty in reliable responses on auditory language tasks. It thus makes sense that children who have superior spoken language comprehension tend to be the ones who display more advanced play and are better at conversational turn-taking. There has been a growing interest in examining potential correspondences between genetic and biological findings and end phenotypes along the spectrum given that the most striking differences between individuals on the autism spectrum are related to IQ (low- vs. high-functioning) and speech and language (Belmonte et.al 2004).

Need for the study

- Being a Special Educator teaching Children with ASD, the inability of these children with limited expressive language was significantly observable
- Enhancing verbal ability among this group necessitated reviewing the various approaches and therapeutic services available to them
- With the focus on Regional language Tamil and with limited research in this area prompted the investigator to develop an assessment tool and an App to enhance Expressive Language skills in Tamil in Children with ASD.

Significance of the study

- The study focuses on the expressive language output in Regional Language (Tamil) of Children with Autism Spectrum Disorder in Tamil Nadu
- Developed PESI App and Spoken Tamil Assessment Tool (STAT-ASD) would significantly help the Therapeutic and Rehabilitation Professionals in assessment and intervention planning
- Developed Assessment tool (STAT-ASD) and PESI App can find a significant phase in assessing and learning Children with Speech and Language Disorder.

Statement of the problem

The study is aimed to enhance the Spoken Tamil Language Ability of Children with Autism Spectrum Disorder in through a Specially developed PEsum SIthiram (PESI) Application based on the following theoretical framework- Picture Exchange Communication System (PECS) (Andy

Bondy and Lori Frost,1985), VARK Model (Fleming & Mills, 1992)and Applied Behaviour Analysis (ABA) (Ivar Lovaas,1960)

Hence the problem statement for the present investigation is

"**Enhancing Spoken Tamil Language Ability in Children with Autism Spectrum Disorder Using PEsum SIthiram (PESI) Application**"

Variables

Testing Variables – Identification and Expressive Language of Single word (Stage I), Expressive Language of Two word sentence (Stage II), Expressive Language of Three word sentence (Stage III)

Experimental Variable – PEsum SIthiram (PESI) Application

Independent Variables – Gender, Age, School and Degree of Disability

Objectives of the study

Primary Objectives

- Development of Spoken Tamil Assessment Tool (STAT-ASD)
- Development of Technology based Spoken Tamil Enhancement Program using developed PEsum SIthiram (PESI) App
- Evaluate Spoken Tamil Language and Communication Skills in Children with Autism Spectrum Disorder before and after intervention.

Secondary Objectives

- Collection and Compilation of Pictures for the Development of Spoken Tamil Assessment Tool
- Development of **PEsum SIthiram(PESI)** Text Material for simple sentence construction(using Subject/ Verb /Object)
- Exploring the possibilities of using PEsum SIthiram (PESI) App in developing Spoken Tamil Language ability of Children with ASD.

Hypothesis of the study

- There is no significant difference between test scores of Stage I (Identification of Pictures and Single Word Expression), II (Expressive Language in Two Word Sentence) and III (Expressive Language with Three Word Sentence) at different trial levels before and after intervention.

- The same applies to other variables such as Gender, School, Age and Degree of disability at Stage I(Identification of Pictures and Single Word Expression), Stage II (Expressive Language in Two Word Sentence) and Stage III (Expressive Language with Three Word Sentence)
- The demographic variables are controlling the Pre Test Score at Stage I(Identification of Pictures and Single Word Expression), Stage II (Expressive Language in Two Word Sentence) and Stage III (Expressive Language with Three Word Sentence)

Scope of the study

Despite the fact that Children with Autism make up three percent of the special needs population, statistics on autism are often inaccurate and incorrect, with insufficient information on their proportion in relation to other mental impairments (Gottfredson, D. C et al., 2015). This may be due to conflating similar clinical symptoms and emotional and social behaviours with other mental illnesses and conditions. Parents and health care providers face this frustrating challenge as the need for more professional specialised treatment and rehabilitation centres grows, which are still falling short of needs and expectations, if not completely lacking. Appropriate services are provided in the private sector, but only to the wealthy who can afford high costs. This undoubtedly has an impact on the education of autistic children.

Mobile technology has had a significant impact on people's behaviour, influencing their daily lives, communication patterns, education, and even interactive business activities. The groundbreaking advancement in the field piqued researchers' interest in expanding their application to include Children with ASD, particularly in response to professionals and special educators who emphasised the importance of diversifying learning and teaching modalities to overcome the inabilities of Children with ASD .

In this regard, mobile technology can help Children with ASD improve their communication skills and through their interaction with others. However, in order to achieve a positive outcome, they require specific features; as visual learners, the application should have a user friendly interface (UI) with good visibility, which will warrant a positive response to visual interaction. With limited software, the embedded design elements should deploy the appropriate amount of information.
The scope of the present study was based on designing and implementing a mobile application as a new educational intervention tool for Children with Autism previously shadowed by a paraprofessional. PEsum SIthiram (PESI) App is an innovative package to improve the verbal and

communication skills of Children with Autism Spectrum Disorder and it can be used as an instructional material in academics and to develop social and communication skills. Rehabilitation Professionals can be benefited by using PESI Application in the Therapeutic field.

Research Gap

PECS is designed in both Printed format and Digitalized mode in particular languages (Dr. Andrew Bondy & Lori Frost, 1985) except Tamil . **Avaz** is one of the AAC methods available in 6 regional languages -Hindi, Tamil, Telugu, Malayalam, Marathi, & Kannada. (Ajit Narayanan, 2011) In Avaz App, single picture explains the full sentence. **Arumbu Mozhi** is also one of the AAC methods to communicate for Non- Verbal Autistic Children (Arumbu Trust, 2019).This App also explains the sentence through the single picture. But PESI Application, Each and every word of the sentence has picture and scroll down option makes the numerous sentences in Tamil and English.

Review of Literature

Autism spectrum disorders (ASD) are a diverse group of conditions. They are characterized by some degree of difficulty with social interaction and communication. Other characteristics are atypical patterns of activities and behaviours, such as difficulty with transition from one activity to another, a focus on details and unusual reactions to sensations. Characteristics of autism may be detected in early childhood, but autism is often not diagnosed until much later (WHO 2021).

Although bilingualism is a common worldwide phenomenon, limited research has considered the experiences of children with autism growing up in bilingual environments. Smith et.al., (2020) examined potential influence of parental bilingualism, and native vs. non-native language use, on responsiveness to children's communication attempts during parent–child interactions where the child with autism. When using their native language, bilingual parents demonstrated reduced frequency of responsiveness (even when controlling for opportunities provided by the child) and less temporal synchrony to child communication compared to English-speaking monolingual parents. Bilingual parents were also less frequently responsive (but not less temporally synchronous) during their native- compared to during their non-native (English) language interactions. Moreover, for bilingual parents, more frequent responsiveness to child communication bids when interacting in non-native English was associated with greater assessed English vocabulary knowledge.

Major advances in multimedia computer technology over the past decades have made sophisticated computer games readily available to the public. Ploog (2019) combined the observation

that most children, including those with autism spectrum disorders (ASD), show an affinity to computers, has led researchers to recognize the potential of computer technology as an effective and efficient tool in research and treatment. The study reviewed the use of computer-assisted technology (CAT), excluding strictly internet-based approaches, to enhance social, communicative, and language development in individuals with ASD by dividing the vast literature into four main areas: language, emotion recognition, theory of mind, and social skills. Although many studies illustrate the tremendous promise of CAT to enhance skills of individuals with ASD, most lack rigorous, scientific assessment of efficacy relative to non-CAT approaches.

Teaching children with autism requires special set of tools and methods, due to decreased level of attention towards stimuli presented and limited capability to learn in the ways typical children do, is manifested most often within this population. Computer-assisted intervention is not only an effective method for developing various skills, allowing both learning with teachers and practicing on their own time without the teacher's direct attention, but it nonetheless increases the motivation and results in faster acquisition of these skills. The results of preliminary study of Hulusic and Pistoljevic (2012) showed that the created software in native language is completely clear and user friendly for kids with Autism and other special needs, and that is systematically and developmentally appropriately sequenced for learning. Additionally, researcher found that children were able to generalize learned skills, through a transfer to a new medium or environment without any needed training (i.e. computer).

Methodology

Autism Spectrum Disorder (ASD) is a condition that impacts brain development leading to problems in perception, socialization and communication. In the current study the investigator has selected school going children of 3 to 10 years of age with Autism in Tiruppur district, Tamilnadu. The sample size was 50 of which 23 children were identified from Inclusive and 27 from special schools with Mild and Moderate degree of disability based on Stratified Random sampling method. A Diagnostic Assessment for the confirmation of Children with Autism from the selected group was implemented with the help of the standardized tool Indian Scale for Assessment of Autism (ISAA,2009). In the present research, the researcher used Quasi-Experimental method. Prior to the Experiment, the Spoken Tamil Language Ability of Children with Autism Spectrum Disorder was assessed by using Developed Tool. There is no Standardized Tamil Tool developed to assess the Ability of Spoken Tamil of Children with Autism Spectrum Disorder. Therefore the investigator developed the Tool: "**Spoken Tamil Assessment Tool for Children with Autism Spectrum Disorder (STAT-ASD)"**. The investigator also developed the Spoken Tamil Assessment Tool for

Children with Autism Spectrum Disorder (STAT- ASD) Booklet used at three different stages. The researcher prepared a scoring key for the developed Assessment Tool. The Assessment tool is objective in nature (Stage I) with 30 test items spread over in each of the three stages of Spoken Tamil Language Assessment Tool developed in Tamil and English.

The investigator took demographic variables as Independent variables, Identification and Expressive Language of Single word (Stage I), Expressive Language in Two word sentence (Stage II), Expressive Language with Three word sentence (Stage III) as Testing Variables and PEsum SIthiram(PESI) Application as the Experimental Variable. Cronbach's Alpha test- Reliability test was done and the Reliability Coefficient is 0.961. Rehabilitation Professionals (N=50) working among Children with Autism Spectrum Disorder were given the Spoken Tamil Assessment Tool (STAT-ASD) to validate on a "Three Point Rating Scale" of Strongly Agree, Agree and Disagree. STAT-ASD consisted of a 90 test items across the three conceptual domains, which are to score depending on the word combinations spoken by the sample. Each item is administered under standard testing conditions and testing methods.

"PESI" is a software application for developing Spoken Tamil Language ability in Children with Autism Spectrum Disorder based on three theoretical frameworks such as i) Picture Exchange Communication System (PECS) developed by Andy Bondy and Lori Frost,1985, ii) Applied Behaviour Analysis (ABA) by Ivar Lovaas,1960and iii) VARK Model by Fleming & Mills, 1992.PEsum SIthiram (PESI) application consists of 290 Pictures (visual), 590 Audios Tamil words (290), English words(290) and Reinforcement(10) Recorded audios, 580 words [Tamil(290) and English(290)] and 290 Touch screens (Kinesthetic approach) and visual and auditory reinforcement. The manual also developed information on downloading and operating the Application. This App is initially developed for android mobiles for the languages Tamil and English. The manual explains the process of developing Spoken Tamil Language ability of Children with Autism Spectrum Disorder Stage wise Viz Stage I (Single word), Stage II (Two word sentence) and Stage III (Three word sentence). PESI Android Application is developed in Ionic version 6.0 with Angular framework 9. PESI Android application developed to support the android OS starts from Kitkat (4.0) to Latest OS Version 12.

Intervention included a workshop and therapy activities. Workshop was conducted for the teachers and parents on the following topics: Autism and Symptoms, Types and behaviour issues, Verbal and Non-verbal Children with Autism, Spoken Tamil Assessment Tool (STAT-ASD), PEsum SIthiram Text material (PESI), PEsum SIthiram (PESI) Application. Every day one hour therapy

session was scheduled along with intervention to the selected sample. Single word pictures (Stage I) were shown and assessed to the selected sample the period of 9 months. Combination of two words Sentence pictures were introduced and assessed among the selected sample on the intervention for 4 months. A Combination of 10 Relations and 105 Action words, we can make 1050 sentences. Combining 175 Objects and 105 Action words, 18,375 sentences. Totally a combination of these two concepts (Stage II), we can make 19,425 sentences. Combination of three words sentence pictures was introduced and examined among the selected sample – the duration for this stage was 2 months. Using all the three concepts (Stage III), 1,83,750 sentences can be made. The total duration for the current study was 15 months. At the end of the intervention Children with ASD could speak 2,03,175 sentences. The study commenced from November 2018 and lasted 15 months up to February 2020.

Data Analysis

- Descriptive Analysis
- Repeated Measures ANOVA
- ANCOVA
- Time series design
- 2x2 Factorial ANOVA

Major Findings

- Intervention provided to the selected sample (N=50) using the PESI Application at Pre test (Mean-7.08) followed by periodic assessment on intervention every 5^{th} month revealed a gradual increase in Identification and use of one word in Expressive Language (Stage I) as reflected in the mean values as follows: First trial – 5^{th} month (Mean-11.08), Second trial – 10^{th} month (Mean- 14.80), Post test – 15^{th} month (Mean-19.22) . Delayed Post test conducted at the end of 22^{nd} month revealed adequate progress achieved by the sample in Expressive use of maximum three words as reflected in the Mean value (24.72)
- At Stage II (use of two words) ,Intervention provided to the selected sample (N=50) using the PESI Application at Pre test (Mean-14.70) followed by periodic Assessment on intervention every 5^{th} month revealed a gradual increase in the use of two words sentence in Expressive Language as reflected in the mean values as follows: First trial – 5^{th} month (Mean-21.40), Second trial – 10^{th} month (Mean- 32.24), Post test – 15^{th} month (Mean-40.76) and Delayed Post test (22^{nd} month) revealed adequate progress achieved by the sample in Expressive use of two words as reflected in the Mean value (49.62)

- With intervention inputs in the identification and use of three words sentence (Stage III) using the PESI Application at Pre test (Mean-19.38) followed by periodic assessment every 5^{th} month revealed a gradual increase in use of three words sentence in Expressive Language is reflected in the mean values as follows: First trial – 5^{th} month (Mean-34.72), Second trial – 10^{th} month (Mean-54.52), Post test – 15^{th} month (Mean-66.00) . Delayed Post test conducted at the end of 22^{nd} month Mean value (75.86) revealed adequate progress achieved by the sample in Expressive use of one to three words
- Repeated Measures of ANOVA between trials (5^{th} month, 10^{th} month, 15^{th} month and 22^{nd} month) and Gender in the of Spoken Tamil Language Ability scores of selected sample (N=50) at Stage I (F(1)=307.99, p=0.00), Stage II (F(1)=322.00, p=0.00) and Stage III (F(1)=450.12, p=0.00) showed that there is a significant difference in the acquisition of Spoken Tamil Language Ability with reference to Gender
- Considering the type of School (Special & Inclusive) which the selected sample are studying, Repeated Measures of ANOVA between the trials (5^{th} month, 10^{th} month, 15^{th} month and 22^{nd} month) with reference to Spoken Tamil Language Ability scores of selected sample (N=50) at Stage I (F(1)=328.15, p=0.00), Stage II (F(1)=247.47, p=0.00) and Stage III (F(1)=252.32, p=0.00) revealed no significant difference with type of School
- Analysing the degree of disability in terms of mild to moderate level in Children with ASD and selected sample (N=50) at Stage I (F(1)=386.86, p=0.00), Stage II (F(1)=425.68, p=0.00) and Stage III (F(1)=537.32, p=0.00) showed significant difference in the acquisition of Spoken Tamil Language Ability
- Sixty percentage of the Children with ASD completed all the Stages (I,II and III) of PEsum SIthiram (PESI) Application after intervention and they are good in their Expressive Language and communication skills.
- Sixty percentage of the Children with ASD completed the Stages I and II of PEsum SIthiram (PESI) Application after intervention and they can speak simple sentences.
- Sixty two percentage of the Children with ASD completed the Stage I alone of PEsum SIthiram (PESI) Application and these children can communicate their needs in one word.
- Twenty two percentage of the Children with Autism Spectrum Disorder could not complete Stage I of PEsum SIthiram (PESI) Application and these children can communicate by other modes of communication such as touch, pointing to pictures, objects and gestures used in the intervention and these children are categorized as Non- Verbal.

Limitations of the Study

- The study is limited to only Single word, Two word sentence and Three word sentence
- The study is limited to schools in Tirupur district alone so it's not applicable for the whole educational system in general.
- The size of the sample for the study was limited to 50 and a larger sample group can strengthen the findings of the study
- The training was provided for 15months, better performance rate specially in generalization of one word to three word would have been being possible if the training was provided for more than two years

Educational implication

- Spoken Tamil Language Ability could be enhanced by using of the PESI mobile application developed
- PESI is a mobile application that is an excellent technique to help children with autism learn verbal skills, particularly expressive language
- PESI is a helpful tool for reducing problematic behaviours in Children who have autism, and it has been shown to have this effect
- Children with ASD can improve their vocabulary skills in Tamil and English by using PESI Application.

Recommendations

- Children speaking other languages other than Tamil are found to be in the selected schools of the study area so there can be more language option developed when an app is made for the Children with Autism
- Attempts can be made to value the use of PESI for other children who have learning disability, specifically in reading the language and comprehending
- Research can be done to get empirical data about the subject matter development in communication skills and a decrease in the use of incorrect expressions by products of using PESI android software as an app to improve verbal abilities among children with autism include behaviour, perseverance, self-discipline, and interpersonal relationship development
- Children with Autism who use the "PESI Android app" can benefit from an investigation to learn more about how it affects their verbal abilities
- Software can be built to help children with special needs learn more advanced literacy abilities, such as complicated verbal skills, mathematical ideas and subject-oriented content

- PESI android app software utilised as an iPad can be used to improve children's verbal skills in the regular classroom routine
- Children with autism who are learning social and etiquette skills through the use of a mobile app developed by Social Stories could benefit from further research into the effects of this software

Conclusion

Expressive Language is critical to the development of independent living abilities. It can assist children with autism improve their sense of who they are and the value they place on themselves. Children with autism who are Non-verbal are more likely to have difficulties adjusting to functioning independently in the community. Children with autism will be able to improve their comprehension of written materials and, more importantly, their ability to express their wants and requirements in a manner that is positive and socially acceptable. This PESI app is found to be significantly increasing the learning skill of the selected Children with Autism as this particular application is very unique as it is been developed in local language of the children in Tamil and it is specially made for children with autism. The children were found to be positively engaged while using the app and their learning skill has developed adequately with longer implication on attaining good Spoken Tamil Language Ability which will pave way for a confident future.

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